

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A lift-and-strike welding process comprising:
 - a. cleaning a surface of a component by applying a first voltage so as to strike an arc between a stud, which is to be connected to the surface, and the surface; and
 - b. reversing the polarity of the first voltage wherein the stud is welded to the surface by at least one arc generated by a second voltage[.]; and
 - c. raising the stud a first distance above the surface for cleaning which is at least two times greater than a second distance the stud is raised for welding.
2. (Previously Presented) The process of Claim 1 further comprising:
setting the first voltage higher than a subsequent second voltage of reverse polarity.
3. (Previously Presented) The process of Claim 2 further comprising:
adjusting the first voltage to a positive polarity.
4. (Previously Presented) The process of Claim 3 further comprising:
coating the stud with a lubricant layer operable with a cold-forming machining operation prior to welding the stud onto the surface.

5. (Previously Presented) The process of Claim 4 further comprising:
- a. reducing the first voltage to a zero-current state;
 - b. using a pilot voltage of a different polarity at the start of the welding process; and
 - c. subsequently raising the voltage to a welding voltage thereafter.
6. (Previously Presented) The process of Claim 5 further comprising:
- maintaining the zero voltage for a predetermined period of time while a second voltage is building up and applying the second welding voltage.
7. (Previously Presented) The process of Claim 6 further comprising:
- a. an electric cleaning current flowing between a surface of the component and the stud welded thereon with the stud resting on the surface;
- lifting the stud off the surface to an approximately constant distance for removing a coating from the surface through ignition of an arc as a cleaning agent;
- b. changing the polarity of the current wherein, afterwards, at least one welding current is produced; and
 - c. welding the stud to the surface.
8. (Previously Presented) The process of Claim 7 further comprising:
- a. using a cleaning current of between 15 amperes and 500 amperes;
- and

b. reducing the cleaning current after the cleaning operation.

9. (Previously Presented) The process of Claim 8 further comprising:

a. reversing the polarity of the current; and

b. applying a maximum welding current to weld the stud to the surface.

10. (Previously Presented) The process of Claim 9 further comprising:

moving the stud into contact with the surface after disconnection of the welding current.

11. (Previously Presented) The process of Claim 10 further comprising:

applying the cleaning current as long as or longer than the pilot current, which is applied prior to applying the welding current.

12. (Previously Presented) The process of Claim 11 further comprising:

applying a welding current that is equal to or stronger than the cleaning current.

13. (Cancelled)

14. (Currently Amended) The process of Claim ~~13~~1 further comprising:
controlling the time period of the cleaning process by measuring the
current at the surface.

15. (Currently Amended) A welding apparatus comprising:
a guide;
a control device for the guide;
a programmed device operable to control or regulate the electric current
and the voltage used for cleaning and welding and;
a welding voltage polarity reverser device operable with the programmed
device to provide a cleaning current that has a polarity opposite that of the welding
current that is produced prior to the welding operation[[.]]; and
an evaluation device operable during cleaning to inspect the quality of
cleaning.

16. (Cancelled)

17. (Previously Presented) The apparatus of Claim 15 wherein:
the programmed device has a focusing device to produce an arc to be
struck.

18. (Currently Amended) The apparatus of Claim ~~17~~ 15 wherein:
the polarity reversing device has a shorted circuit operably maintaining the struck arc during a reversal of the polarity.
19. (Cancelled)
20. (Currently Amended) The apparatus of Claim ~~19~~ 15 wherein:
the polarity reversing device has a circuit element; and
the circuit element produces an arc current that maintains the struck arc during the reversal of a polarity of the arc voltage.
21. (Previously Presented) The apparatus of Claim 15 further comprising:
a first power source formed in the polarity reversing device to supply a cleaning current to the welding apparatus; and
a second power source formed in the polarity reversing device to supply a pilot current and a welding current to the welding apparatus.
22. (Previously Presented) The apparatus of Claim 21 further comprising:
a coil connected to the second power source to maintain the struck arc during the reversal of the polarity.

23. (Currently Amended) The apparatus of Claim 15 wherein:
the surface is ~~formed of~~ aluminum; and
the surface has a lubricant coating placed ~~formed~~ thereon during its
manufacture.

24. (Currently Amended) The Claim 15 wherein:
the surface is ~~formed of~~ steel sheet; and
the surface has a lubricant coating placed ~~formed~~ thereon during its
manufacture.

25. (Currently Amended) A welding process comprising:
a. cleaning a surface of a component using a cleaning arc generated
by a first voltage; ~~and~~
b. reversing a polarity of said first voltage to produce a second voltage
that generates a welding arc[.]; and
c. causing said first voltage to be greater than said second voltage.

26. (Previously Presented) The welding process of Claim 25, further
comprising:
welding an element to the component using said welding arc.

27. (Cancelled)

28. (Previously Presented) The welding process of Claim 25, wherein said cleaning arc is struck between the surface and an element to be welded to the surface.

29. (Previously Presented) The welding process of Claim 26, wherein the element is a welding stud.

30. (Previously Presented) The welding process of Claim 25, wherein said first voltage has a positive polarity and said second voltage has a negative polarity.

31. (Previously Presented) The welding process of Claim 25, wherein the component is aluminum.

32. (Previously Presented) The welding process of Claim 25, wherein the component is a steel sheet.

33. (Previously Presented) The welding process of Claim 26, further comprising:

coating the element with a lubricant layer for a cold-forming machining operation prior to said welding step.

34. (Previously Presented) The welding process of Claim 25, further comprising:

a. reducing said first voltage to a zero-current state; and

b. reversing said polarity of said first voltage to produce said second voltage when said first voltage is at said zero-current state.

35. (Previously Presented) The welding process of Claim 26, wherein said cleaning step comprises cleaning the surface only in an area where the element is welded to the surface.

36. (Previously Presented) The welding process of Claim 26, further comprising:

- a. setting said first voltage to a zero-current state as the element is moved toward the surface;
- b. contacting the element with the surface; and
- c. lifting the element from the surface to ignite said welding arc.

37. (Previously Presented) The process of Claim 25, further comprising:

- a. using a first voltage of between 15 amperes and 500 amperes; and
- b. reducing said first voltage after said cleaning step.

38. (Previously Presented) The process of Claim 25, further comprising:

raising the element to a predetermined first distance above the surface to perform said cleaning step that is at least two times greater than a second distance that the element is raised above the surface to perform said welding step.

39. (Previously Presented) The process of Claim 25, wherein during said reversing step one of said first voltage and said second voltage continuously flows between the element and the surface such that one of said cleaning arc and said welding arc remains lit.

40. (Currently Amended) A process operable to weld an element to a component, the process comprising:

a. contacting the element to be welded to a surface of the component with the surface such that a first voltage flows between the element and the surface;

b. lifting the element from the surface to ignite a cleaning arc operable to clean the surface;

c. cleaning the surface with said cleaning arc;

d. re-contacting the element to a surface of the component;

~~[[d]]e.~~ reversing a polarity of said first voltage to produce a second voltage ~~that generates a welding arc; and~~ such that said second voltage flows between the element and the surface;

f. lifting the element from the surface to ignite a welding arc capable of welding; and

~~[[e]]g.~~ welding the element to the surface using said welding arc.

41. (Previously Presented) The process of Claim 40, wherein said first voltage is reduced to zero and said cleaning arc is extinguished before said reversing step.

42. (Cancelled)

43. (Previously Presented) The process of Claim 40, wherein one of said first voltage and said second voltage continues to flow between the element and the surface during said reversing step such that one of said cleaning arc and said welding arc remains ignited during said reversing step.

44. (Previously Presented) The process of Claim 40, wherein the element is brought into contact with the surface to generate said welding arc.

45. (Previously Presented) The process of Claim 40, wherein said first voltage is higher than said second voltage.

46. (Previously Presented) The process of Claim 40, wherein said first voltage has a positive polarity and said second voltage has a negative polarity.

47. (Previously Presented) The process of Claim 40, wherein said cleaning step comprises cleaning the surface only in an area where the element is welded to the surface.

48. (Previously Presented) The process of Claim 44, wherein the element is lifted to a first distance for cleaning during said lifting step occurring prior to said reversing step that is at least two times greater than a second distance that the element is lifted above the surface during said lifting step occurring subsequent to said reversing step.

49. (Currently Amended) A welding apparatus comprising:
a programmed device operable with a cleaning current and a welding current; and
a polarity reversing device to provide said cleaning current and said welding current with opposite polarities[[]]; and
a coil connected to a power source to maintain an arc during operation of said polarity reversal device.

50. (Previously Presented) The apparatus of Claim 49, further comprising a guide operable to guide said element into contact with said surface that said element is to be welded upon.

51. (Previously Presented) The apparatus of Claim 50, wherein said guide guides said element into contact with said surface to produce a cleaning arc.

52. (Previously Presented) The apparatus of Claim 50, wherein said guide guides said element into contact with said surface to produce a welding arc.

53. (Previously Presented) The apparatus of Claim 49, further comprising a control device operating said guide.

54. (Previously Presented) The apparatus of Claim 49, wherein said programmed device has a focusing device to produce an arc.

55. (Previously Presented) The apparatus of Claim 49, wherein said cleaning current produces a cleaning arc operable to clean said surface.

56. (Previously Presented) The apparatus of Claim 49, wherein said welding current produces a welding arc operable to weld said element to said surface.

57. (Previously Presented) The apparatus of Claim 49, wherein said polarity reversing device produces a shorted circuit operable to maintain an arc as said cleaning current is terminated and said welding current is activated.

58. (Previously Presented) The apparatus of Claim 49, wherein said cleaning current is positive and said welding current is negative.

59. (Previously Presented) The apparatus of Claim 49, wherein said cleaning current is brought to a zero current state before said polarity reversing device converts said cleaning current to said welding current.

60. (Previously Presented) The apparatus of Claim 49, wherein said cleaning current is powered by a first power source and said welding current is powered by a second power source that is different than said first power source.

61. (Cancelled)

62. (New) A welding apparatus comprising:
a programmed device operable with a cleaning current and a welding current;
a polarity reversing device to provide said cleaning current and said welding current with opposite polarities; and
a first power source operable to provide said cleaning current and a second power source operable to provide said welding current.

63. (New) The apparatus of Claim 62, further comprising a guide operable to guide said element into contact with said surface that said element is to be welded upon.

64. (New) The apparatus of Claim 63, wherein said guide guides said element into contact with said surface to produce a cleaning arc.

65. (New) The apparatus of Claim 63, wherein said guide guides said element into contact with said surface to produce a welding arc.

66. (New) The apparatus of Claim 62, further comprising a control device operating said guide.

67. (New) The apparatus of Claim 62, wherein said programmed device has a focusing device to produce an arc.

68. (New) The apparatus of Claim 62, wherein said cleaning current produces a cleaning arc operable to clean said surface.

69. (New) The apparatus of Claim 62, wherein said welding current produces a welding arc operable to weld said element to said surface.

70. (New) The apparatus of Claim 62, wherein said polarity reversing device produces a shorted circuit operable to maintain an arc as said cleaning current is terminated and said welding current is activated.

71. (New) The apparatus of Claim 62, wherein said cleaning current is positive and said welding current is negative.

72. (New) The apparatus of Claim 62, wherein said cleaning current is brought to a zero current state before said polarity reversing device converts said cleaning current to said welding current.

73. (New) The apparatus of Claim 62, said apparatus further comprising:
a coil connected to a power source to maintain an arc during operation of said polarity reversal device

74. (New) A welding apparatus comprising:
a controller operable to provide a cleaning current and a welding current of opposite polarities; and
a polarity reversing device having a circuit which produces an arc current and prevents the extinction of the arc when the current passes through zero and the polarity is reversed.

75. (New) The apparatus of Claim 74, further comprising a focusing device to produce an arc to be struck.

76. (New) The apparatus of Claim 74, wherein said polarity reversing device has a shorted circuit operably for maintaining the struck arc during a reversal of polarity.

77. (New) A welding apparatus comprising:

a controller operable to provide a first current for cleaning and a second current for welding;

a polarity reverser operable to provide said first current with a polarity opposite of said second current; and

an evaluator operable to inspect the quality of the cleaning.

78. (New) The apparatus of Claim 77 wherein:

said evaluator measures a variation of the arc voltage or current in order to regulate the duration of cleaning.

79. (New) The apparatus of Claim 78 wherein:

said evaluator communicates with said controller to terminate the cleaning operation.

80. (New) The apparatus of Claim 77 wherein:

said evaluator communicates with said polarity reversing device to reverse polarity and initiate said second current for welding.

81. (New) The apparatus of Claim 77 further comprising:

memory operably recording appropriate control parameters.

82. (New) A welding apparatus comprising:

- a controller operable to provide a cleaning current and a welding current;
- a polarity reverser operable to provide said cleaning current with a polarity opposite of said welding current;
- a power source; and
- a conductor connected to said power source operable to maintain an arc during operation of said polarity reverser.

83. (New) The apparatus of Claim 82 wherein:

- alternating current flows through said conductor.

84. (New) The apparatus of Claim 83 wherein:

- said alternating current is controlled so that it influences an arc shape in such a way to clean only in the region to be welded.

85. (New) The apparatus of Claim 83 wherein said conductor is a coil which is operated with an alternating current between about 8 and 30 volts.

86. (New) The apparatus of Claim 82 wherein:

- a current intensity between about 0.1 and 0.2 amperes is used.

87. (New) The apparatus of Claim 82 further comprising:

a collet operable to guide a weld-on element; and
a housing surrounding said collet, around which said conductor is
disposed.